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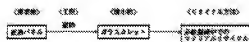
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(54) METHOD OF DISPOSAL FOR LIQUID CRYSTAL PANEL

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce the quantity of disposal of waste liquid crystal panels to a landfill to reduce costs associated with the treatment.

SOLUTION: Liquid crystal panels leaving a liquid crystal plant or the like are sheared and crushed by a uniaxial shearing crusher with liquid crystals being contained therein to turn them into glass cullet. After that, the glass cullet is fed into a nonferrous smelting furnace of about 1200°C. The waste liquid crystal panels may be in a state in which polarizing plates and liquid crystal driver IC's are attached thereto. In this case, treatment costs associated with complex removing work of each constituting member can be reduced. Glass contained in the crushed waste is used for iron removing treatment in the nonferrous smelting furnace (material recycling) and on the other hand, organic matter such as the



polarizing plates and liquid crystals is made combustion material and is thermally recycled. And the liquid crystals contained in the glass cullet are decomposed by high temperature in the nonferrous smelting furnace and metal chromium is turned into oxide to make harmless the two.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the discarding treatment method of the liquid crystal panel which became badly or unnecessary.

[0002]

[Description of the Prior Art] It is the situation of the quantity of domestic wastes or industrial waste increasing in recent years, and worrying about the residual years of reclaimed ground. Since the industrial activity which considered environment more has come to be called for, the request which asks for the recycling about wastes, such as reducing the industrial waste from a factory, home electronics, and information machines and equipment, is increasing increasingly, and recycling of home electronics etc. is promoted from the administration side etc.

[0003] For example, about CRT (Cathode Ray Tube) which is a display, glass is cut, an electron gun and a fluorescent substance are removed, the recycling technology which carries out reproduction use is proposed as a glass cullet (glass waste) by the original glass for CRT, and it has already carried out partly. For example, although JP,H8-267455,A is indicating the disposal system of a disposable-household-electric-appliances article, in this system, large-sized-glass products, such as a cathode-ray tube, are processed by the caret with the large-sized-glass processing unit.

[0004] For example, JP,H6-316446,A, The glass plate of at least two sheets the glass laminate for windows laminated via the interlayer made of a synthetic resin. It cuts in a predetermined size, and is considered as a wafer, this is supplied to the exfoliation tub which has a vortex function of air, an air vortex style separates a glass laminate into a glass split and an interlayer, and the method of collecting glass is indicated.

[0005] The defect who is the same display as CRT and is discharged by a liquid crystal panel production plant, a liquid crystal module production plant, product maker, etc. on the other hand, or the liquid crystal panel which became unnecessary, Or in the case of the liquid crystal panel (below, these liquid crystal panels are called waste liquid crystal panels) which comes out from the information display device discarded in a commercial scene, a graphic display device, etc., managed type reclamation of the most is generally carried out. On the other hand, the actual condition is that reclamation processing of the waste liquid crystal panels contained in wastes, such as home electronics and information machines and equipment, is carried out with the shredder dust which is crushed the whole product by a treatment facility and contains a plastic so much since it is small as a quantity of waste, or incineration processing is carried out.

[0006] A liquid crystal material is poured in inside two glass substrates pasted together to the above-mentioned liquid crystal panel. It encloses, a polarizing plate (resin) is stuck on the outside of each glass substrate, a liquid crystal module says the whole indicator containing the above-mentioned liquid crystal panel, and it is constituted including a liquid crystal driving driver board, a control board, a light guide plate, an optical sheet, a metallic frame, a fluorescent tube, etc.

[0007]

[Problem(s) to be Solved by the Invention]By the way, since a liquid crystal panel is a display which can contribute to power saving and saving resources, From now on, with progress of a highly informative society, the quantity of production increases rapidly, and also enlarging the display surface product is predicted, and waste liquid crystal panels will also be expected that a number and quantity increase quickly in connection with this. [0008]However, in the conventional discarding treatment method corresponding by mainly carrying out reclamation processing of the waste liquid crystal panels, when waste liquid crystal panels increase from now on, the problem that there is a possibility that it may become impossible for a limit to come and abandon to an abandonment space arises. [0009]In the former, the actual condition is that the discarding treatment method of the suitable liquid crystal panel was not established, but technical establishment etc. are behind compared with CRT, other home electronics, or parts. Therefore, establishment of the discarding treatment method offered on the increase in waste liquid crystal panels will be required immediately from now on.

[0010]Made in order that this invention might solve the above-mentioned problem, the purpose is to provide the discarding treatment method of a liquid crystal panel that the amount of abandonment to the reclaimed ground of waste liquid crystal panels can be stopped as much as possible.

[0011]

[Means for Solving the Problem]In order to solve above-mentioned SUBJECT, in a discarding treatment method of a liquid crystal panel which carries out discarding treatment of the liquid crystal panel which became unnecessary, a discarding treatment method of a liquid crystal panel concerning an invention of Claim 1 crushes a liquid crystal panel, after a liquid crystal has entered at least, and is characterized by carrying out recycle processing of the crushed waste.

[0012]Since according to the above-mentioned composition a liquid crystal panel which became unnecessary, i.e., waste liquid crystal panels, is crushed and recycle processing of this is carried out, discarding quantity to reclaimed ground of waste liquid crystal panels can be reduced. Thereby, it can respond also to increase of waste liquid crystal panels accompanying increase of demand of future liquid crystal panels.

[0013]Since waste liquid crystal panels are crushed after a liquid crystal has entered at least, it is unnecessary, and a process of extracting a liquid crystal can make unnecessary an extracting apparatus and a help concerning this extraction process, and can reduce a cleanup cost. By carrying out crushing treatment of the waste liquid crystal panels, capacity of waste liquid crystal panels is reduced substantially, and becomes easy [storage or transportation].

[0014]In order that a discarding treatment method of a liquid crystal panel concerning an invention of Claim 2 may solve above-mentioned SUBJECT, in composition of Claim 1, the above-mentioned recycle processing is characterized by being the processing which throws a crushed liquid crystal panel into a non-iron refining furnace.

[0015]A liquid crystal panel is the structure which pinched a liquid crystal layer with two glass substrates, and the above-mentioned glass substrate contains a lot of SiO_2 . Therefore, above SiO_2 combines with iron by a chemical reaction in a non-iron refining furnace by throwing a crushed liquid crystal panel into a non-iron refining furnace. Therefore, an impurity (for example, iron) which exists in a non-iron refining furnace can be removed by performing such processing.

[0016]Although organic matters, such as a polarizing plate and a liquid crystal, are contained in a crushed liquid crystal panel, since such an organic matter serves as a combustion material, a non-iron refining furnace can be heated with energy saving.

[0017]A discarding treatment method of a liquid crystal panel concerning an invention of Claim 3 is characterized by crushing a liquid crystal panel with 1 axis shearing type shredder in Claim 1 or composition of 2, in order to solve above-mentioned SUBJECT.

[0018]A liquid crystal panel is different, and as mentioned above, detailed structure of CRT is complicated [a liquid crystal panel] by lamination, attachment, etc. of a thin film. That is, a liquid crystal material and a protective thin film are several micrometer thickness, and polarizing plates are multilayer structure, such as TAC (triacetyl cellulose), an acrylic resin, and PVA (polyvinyl alcohol), in hundreds of micrometer thickness. In addition, materials, such as many kinds of organic matters and a metal membrane, are laminated by filmy voice. A circuit for a liquid crystal drive around a liquid crystal panel by TCP method (Tape Carrier Package; film mounting structure) or a COG method (Chip On Glass; bare chip mounting structure). A member which consists of various materials, such as a connecting material and sealing resin, is attached in many cases. Therefore, in the former, even if it carried out crushing treatment, a liquid crystal panel in which a charge of hardwood and a charge of soft wood were laminated as mentioned above was difficult to divide in suitable shape.

[0019]However, 1 axis shearing type shredder is the structure which can crush crushing material finely until it serves as a size which can pass through a hole of a sieve with which the crusher concerned is provided, and it can be most finely crushed now compared with other for example, biaxial shearing type shredder and crushers. Therefore, by using such 1 axis shearing type shredder for crushing of waste liquid crystal panels in the above-mentioned composition, Even if a polarizing plate, a circuit for a liquid crystal drive, etc. are attached to waste liquid crystal panels even if and a charge of hardwood and a charge of soft wood are laminated, waste liquid crystal panels can be crushed certainly, capacity in a total of waste liquid crystal panels can be reduced certainly, and this can also perform storage and transportation still more easily.

[0020]Waste liquid crystal panels become waste with fine size and shape which is easy to throw for example, into a non-iron refining furnace by crushing by 1 axis shearing type shredder. Therefore, when throwing in and carrying out recycle processing of the crushed waste to a non-iron refining furnace, crushed waste can be thrown in in large quantities, reduction efficiency of an impurity can be raised, and recycle processing can be performed in the state where it was dramatically stabilized by this.

[0021]A discarding treatment method of a liquid crystal panel concerning an invention of Claim 4 is characterized by crushing a liquid crystal panel, where a polarizing plate is attached in one composition of the Claims 1-3, in order to solve above-mentioned SUBJECT.

[0022]Generally, removing operation of a polarizing plate is difficult to automate, and there is much handicraft. However, since complicated removing operation of such a polarizing plate is unnecessary according to the above-mentioned composition, discarding treatment can be simplified and a cleanup cost can be reduced certainly.

[0023]A discarding treatment method of a liquid crystal panel concerning an invention of Claim 5 is characterized by a circuit for a liquid crystal drive crushing a liquid crystal panel in the state where it was connected in one composition of the Claims 1-4, in order

to solve above-mentioned SUBJECT.

[0024]Although removing methods of a circuit for a liquid crystal drive generally include a method of only exfoliating a circuit for a liquid crystal drive from a liquid crystal panel, a way a cutter knife etc. cut a circuit for a liquid crystal drive from a liquid crystal panel, etc., it is the method of all performing manually. However, in the above-mentioned composition, since complicated removing operation of such a circuit for a liquid crystal drive is unnecessary, discarding treatment can be simplified and a cleanup cost can be reduced certainly.

[0025]

[Embodiment of the Invention]It will be as follows if one gestalt of operation of this invention is explained based on drawing 1 thru/or drawing 5.

[0026]An example of the liquid crystal panel which can apply the discarding treatment method of the liquid crystal panel of this invention is shown in drawing 2. The illustrated liquid crystal panel is provided with active elements (not shown), such as TFT (Thin Film Transistor). Of course, this invention is applicable also to duty liquid crystal panels, such as TN (Twisted Nematic) liquid crystal panel and a STN (Super Twisted Nematic) liquid crystal panel.

[0027]The liquid crystal panel of this embodiment pastes together 0.7 mm in thickness, or the 1.1-mm transparent glass substrates 1a and 1b via the sealing member 2 arranged to frame shape along with the periphery of the glass substrates 1a and 1b concerned, for example, and has structure made to fill up with a liquid crystal between them. Although the glass substrates 1a and 1b are constituted having included SiO₂ 50 to 70%, they are not necessarily limited to this figure. The 0.2-0.4-mm-thick polarizing plates 4a and 4b are stuck on the field of an opposite hand via a binder, respectively in the liquid crystal layer 3 in the glass substrates 1a and 1b. Generally the thickness (distance between glass substrate 1a and 1b) of the liquid crystal layer 3 is 4-6 micrometers. The thickness of the glass substrates 1a and 1b, the polarizing plates 4a and 4b, and the liquid crystal layer 3 is not necessarily limited to the above-mentioned value.

[0028]The light filter 5 which made the organic matter the subject, the transparent electrode 7 which consists of a transparent film (ITO (Indium Tin Oxide) film) containing indium, and the orienting film 8 which consists of organic matters are laminated in this order toward the liquid crystal layer 3 side by the field by the side of the liquid crystal layer 3 of the glass substrate 1a. Between each light filter 5.5, the antireflection film 6 which consists of chromium metals is formed.

[0029]On the other hand, in the field by the side of the liquid crystal layer 3 of the glass substrate 1b. The bus electrode 9 which consists of a metal membrane of tantalum, aluminum, or the titanium etc., the picture element electrode 10 which consists of a transparent film (ITO film) containing indium, and the orienting film 11 which consists of organic matters are laminated in this order toward the liquid crystal layer 3 side.

[0030]The thickness of each of these electrodes and a film is thickness thin enough compared with the thickness of the glass substrates 1a and 1b.

[0031]To the liquid crystal panel of such composition, the driver IC for a liquid crystal drive (Integrated Circuit), The member of many including a connecting material, a printed circuit board, resistance, a capacitor part article, etc. was attached directly or indirectly, and was united with the liquid crystal module (not shown). Although the above-mentioned driver IC for a liquid crystal drive is attached to the liquid crystal panel,

for example by the TCP method, it may be attached by the COG method.

[0032]By the way, in this embodiment, in order to do the crushing test of a liquid crystal panel by the crusher mentioned later, the liquid crystal panel of three gestalten was prepared by the existence of the driver IC for a liquid crystal drive, and the existence of the polarizing plates 4a and 4b. Namely, as lot No. A as the liquid crystal panel and lot No. B which removed both the driver IC for a liquid crystal drive, and the polarizing plates 4a and 4b, They are the liquid crystal panel which removed only the driver IC for a liquid crystal drive, and left the polarizing plates 4a and 4b, and the liquid crystal panel which left the driver IC for a liquid crystal drive, and the polarizing plates 4a and 4b both as lot No. C.

[0033]Next, the crusher used by this embodiment is explained below based on drawing 3 thru/or drawing 5. According to this embodiment, three kinds, 1 axis shearing type shredder marketed, biaxial shearing type shredder, and a crusher (hammer crusher), were used. First, 1 axis shearing type shredder is explained.

[0034]Drawing 3 shows the sectional view of the crushing chamber of 1 axis shearing type shredder. As shown in the figure, 1 axis shearing type shredder has the pivotable cylindrical idiosoma 21, for example with the comparatively quick revolving speed of 400-800 rpm. The idiosoma 21 is installed so that the axis of rotation may be located horizontally, and two or more rotary blades 22 are formed in the side in one with the idiosoma 21. In the figure, although the three rotary blades 22 are formed, it is not necessarily limited to this number.

[0035]And the stationary knives 23 and 23 are formed in the wall of the crushing chamber when the idiosoma 21 rotates so that a fixed crevice may be formed between the rotary blades 22, and so that it may be crowded on both sides of the idiosoma 21. By adjusting appropriately the crevice between the rotary blade 22 and the stationary knife 23, it is possible to crush crushing material in arbitrary sizes.

[0036]Rather than the two stationary knives 23 and 23, the side and prescribed distance of the idiosoma 21 get used to a downward position, and the sieve 24 of mesh state is formed in it. Each end of the sieve 24 has adhered near [edge of a blade] each [of the stationary knives 23 and 23].

[0037]Shearing crushing of the crushing material which will have fallen from the figure upper part by such composition if the idiosoma 21 rotates is carried out between the rotary blade 22 and the stationary knife 23, and it is caudad discharged as crushed waste from the hole of the sieve 24 established in the crushing chamber lower part. At this time, what cannot pass through the hole of the sieve 24 will be crushed any number of times until it serves as a size which can be passed. It turns out that there is little crushed waste discharged from the hole of the sieve 24 at the low rpm of the rotary blade 22, and it increases in number conversely according to a high rpm.

[0038]Without shortening the life by such a structure, the size of crushed waste being arranged easily and arbitrarily, and applying power with the edge of a blade impossible for, it is thin until it is set to about 5 mm, and a maximum droplet size can be crushed small. Thereby, it becomes possible to put into the FUREKON back (a flexible container bag's abbreviation), and to convey, without grinding the secondary crushed waste.

[0039]With 1 axis shearing type shredder, the maximum droplet size of crushed waste can be stabilized at about 5-10 mm. Thereby, it becomes the size and shape which are easy to supply to the below-mentioned non-iron refining furnace, and crushed waste

throws crushed waste into a non-iron refining furnace in large quantities, and it becomes possible to carry out recycle processing in large quantities.

[0040]Since the edge of crushed waste also becomes comparatively round, even if it puts crushed waste into the FUREKON back, crushed waste breaks through the FUREKON back and is not sprinkled outside. Therefore, a worker gets injured at the time of conveyance, or there is little danger of the trouble which damages the surrounding thing.

[0041]Although the rotary blade 22 rotates at 400-800 rpm, by controlling this number of rotations, the burden which crushes the thrown-in crushing material efficiently and starts the edge of a blade to rotate can be made small, and, as a result, the life of an edged tool can be prolonged. Since the rotary blade 22 carries out a high velocity revolution, there is also a crushing effect by blow operation.

[0042]Next, biaxial shearing type shredder is explained. Drawing 4 shows the sectional view of the crushing chamber of biaxial shearing type shredder. As shown in the figure, biaxial shearing type shredder has the pivotable cylindrical idiosomas 25 and 26, for example with revolving speed comparatively later than 1 axis shearing type shredder of 20-100 rpm. The rotary blade 27 which became comb blade-like in the shaft direction is formed in the side of the idiosoma 25 in one with the idiosoma 25. The rotary blade 28 which became comb blade-like in the shaft direction is formed also in the side of the idiosoma 26 in one with the idiosoma 26. In the figure, although every six rotary blades 27 and 28 are formed, they are not necessarily limited to this number.

[0043]The idiosomas 25 and 26 are located so that the axis of rotation may become horizontal, and moreover, they are installed so that the rotary blades 27 and 28 may get into gear mutually at the time of the rotation, the mutual sides may separate prescribed distance and they may counter. The idiosomas 25 and 26 rotate to an opposite direction mutually so that shearing crushing of the crushing material which falls from the upper part may be carried out and it can be led in the outlet 29 direction with the rotary blades 27 and 28.

[0044]Biaxial shearing type shredder is not provided with the sieve 24 (refer to drawing 3) which is in 1 axis shearing type shredder on the structure, but seldom fits thin crushing. So, in this embodiment, the distance of the shaft direction of one edge of the rotary blade 27 and one edge of the rotary blade 28 was set as 10 mm near a limit in respect of the life.

[0045]Shearing crushing of the crushing material which has fallen between the idiosomas 25,26 from the figure upper part with the shooter etc. is carried out by such composition between the rotary blade 27 and the rotary blade 28 which rotate to an opposite direction mutually. At this time, the shape of crushed waste turns into shape of the shape of a strip of paper corresponding to the thickness (distance of the edged tool between biaxial [adjacent]) of the comb blade-like rotary blade 27 and the edge of the rotary blade 28. And crushed waste is caudad discharged from the outlet 29 provided in the crushing chamber lower part.

[0046]In biaxial shearing type shredder, although the number of rotations of the two rotary blades 27 and 28 may be the same, it can crush more efficiently by giving some gap to number of rotations.

[0047]Next, a crusher is explained. Drawing 5 shows the sectional view of the crushing chamber of a crusher. As shown in the figure, the crusher is provided with the rotating hammer 30 in the center of a crushing chamber. This rotating hammer 30 rotates, for

example at the number of rotations about the middle of the number of rotations of the idiosoma 21 of 1 axis shearing type shredder, and the number of rotations of the idiosomas 25 and 26 of biaxial shearing type shredder, and consists of the cylindrical idiosoma 31 and the lobe 32 projected from that side. In the figure, although the six lobes 32 are formed, they are not necessarily limited to this number.

[0048]In this composition, the crushing material which has fallen from the shooter which leads above the rotating hammer 30 is struck by the rotating hammer 30, collides with the wall 33 ahead of a crushing chamber, and is crushed with the shock at the time of a collision. Crushed waste is discharged via the outlet 34 of a crushing chamber.

[0049]Thus, since a crusher crushes by giving a shock to crushing material, a weak thing hard as a crushing material has the advantage that it can crush finely, but as for the reverse thing, the fault that it is bad also has crushing efficiency.

[0050]Next, the crushing test was done to each liquid crystal panel of lot No. A-C using each above-mentioned crusher. The result is shown in Table 1.

[0051]

[Table 1]

ロットNo.	液晶パネルの状態	破砕方式		
		1軸剪断式	2軸剪断式	衝撃式
A	ドライバIC無し 偏光板無し	◎	△	○ ※
B	ドライバIC無し 偏光板有り	◎	△	×
C	ドライバIC有り 偏光板有り	◎	△	×

◎：最も良好 ○：良好 △：可 ×：不可
※：COG実装パネルでは◎

[0052]In 1 axis shearing type shredder, three kinds of all liquid crystal panels could be crushed easily, and the best result was obtained. The size of crushed waste had also gathered compared with other two methods, and was around 5 mm. It was almost the case which has divided into each the glass substrates 1a and 1b and the polarizing plates 4a and 4b which were crushed.

[0053]The rate of reduction in comparison with the case where it does not crush is also as the best as one half (50%), and the result which shows an advantageous thing in respect of a transportation cost was obtained. It is a rate of specific volume bulk, the rate of reduction is expressed with (apparent specific gravity / true specific gravity), and it shows that reduction is carried out, so that a value is small.

[0054]Generally, since 1 axis shearing type shredder requires time for crushing even if it has small throughput and it compares it with a crusher compared with biaxial shearing type shredder, since only one piece is provided with the edged tool, it is said that throughput is small, but. Even if it takes into consideration the future amount of discarding treatment of the waste liquid crystal panels assumed, the throughput of 1 axis shearing type shredder is enough, and it can say that it is not a problem.

[0055]On the other hand, even if it set it as 10 mm which mentioned above the width of the rotary blades 27 and 28 in biaxial shearing type shredder, in the case of the liquid crystal panel of lot No. A, the glass piece several centimeters in length mixed, and the

edge was also sharp. Although in the case of the liquid crystal panel of lot No. B-C glass is pulled by the polarizing plates 4a and 4b and is crushed finely, the polarizing plates 4a and 4b. There was much what was judged in the shape of [over 10 cm in length] a strip of paper, and it was in the state where it has adhered without the glass which became in pieces at most of the polarizing plates 4a and 4b dissociating.

[0056]As a result, the rate of reduction was [in lot No. A] as bad as 1/1 at 1/1.7 and lot No. B-C, and its effect was small compared with 1 axis shearing type shredder.

[0057]In the crusher, at lot No. A, the maximum droplet size of crushed waste is about 3 mm, and the good result was obtained. In the case where the COG package of the driver IC for a liquid crystal drive is being carried out especially, since there was no TAB (Tape Automatic Bonding) tape, it was crushed quite good. On the other hand, in lot No. B-C, the polyimide film currently used for the polarizing plates 4a and 4b or the driver IC for a liquid crystal drive was not crushed. With a crusher, a lot of raising dust occurs, and even if it attaches a dust catcher, it is thought that there is a fear of work environment being polluted.

[0058]From the above result, it can say that 1 axis shearing type shredder fits crushing of a liquid crystal panel most. It was, and also in the worn crushing test, the liquid crystal was discharged in the state where it adhered to the glass piece, and it hardly remained to the inside of a plane. Although the liquid crystal was neglected under an 80 °C elevated temperature for a long time and the weight change was measured, change of reduction etc. is not accepted but it can be said that most evaporation cannot be found.

[0059]As for the above result, except for the case where a crusher is used, the result also with same liquid crystal panel that carried out the COG package was obtained.

[0060]So, in this embodiment, discarding treatment of waste liquid crystal panels was performed as follows using the above-mentioned 1 axis shearing type shredder.

[0061]As shown in drawing 1, with the above-mentioned 1 axis shearing type shredder, carry out shearing crushing of the waste liquid crystal panels which come out from a liquid crystal factory etc., or the waste liquid crystal panels which come out from an information display device, a graphic display device, etc., and let them be a glass cullet. At this time, it is a thing in the state where a liquid crystal, the polarizing plates 4a and 4b, and liquid crystal driver IC were included, as the above-mentioned waste liquid crystal panels. That is, taking advantage of the liquid crystal layer 3 (refer to drawing 2) being very as thin as 4-6-micrometer thickness, and being little, and being the material which hardly evaporates, where a liquid crystal is included at least, crushing treatment is carried out. Then, the glass cullet (crushed waste) obtained by the above-mentioned crushing is thrown into about 1200 °C non-iron refining furnace.

[0062]Since the crushed waste obtained by crushing with 1 axis shearing type shredder contains SiO₂ 50 to 70% at this time, in a non-iron refining furnace, crushed waste and iron join together by a chemical reaction, and iron which is an impurity is removed. In this case, crushed waste is used for other processings (iron removal) in the material state - what is called -- it means that material recycle was carried out. It means that organic matters in crushed waste, such as the polarizing plates 4a and 4b and a liquid crystal, serve as a combustion material to which combustion in a non-iron refining furnace is urged, and thermal recycling was carried out on the other hand. The thing good as a result of a series of above-mentioned processings was actually obtained.

[0063]It not only can crush waste liquid crystal panels, but in the discarding treatment

method of the above-mentioned liquid crystal panel, since recycle processing is carried out with the non-iron refining furnace after that, it can reduce certainly the discarding quantity to the reclaimed ground of waste liquid crystal panels. An abandonment space is easily securable, even if the demand of liquid crystal panels grows and the number of waste liquid crystal panels will also increase in connection with it by this from now on. [0064] Since waste liquid crystal panels are crushed where a liquid crystal, the polarizing plates 4a and 4b, the driver for a liquid crystal drive, etc. are included, complicated crushing pretreatment which removes them is unnecessary. Thereby, the processing time, the introductory devices, treatment facilities, and helps concerning crushing pretreatment can be reduced, and the cost which the whole discarding treatment including recycle processing takes can be reduced substantially. Since the capacity of waste liquid crystal panels can be substantially reduced by carrying out crushing treatment of the waste liquid crystal panels, storage and transportation can also be performed easily, and the cost which it takes is also reducible.

[0065] By using 1 axis shearing type shredder, there is no crack of the liquid crystal panel by a worker's inattention, and it can work safely for a worker. Since material recycle of the glass which occupies the great portion of weight of waste liquid crystal panels is carried out, it also becomes using resources carefully.

[0066] By the way, although the toxicity of the liquid crystal material included in a liquid crystal panel was so small in the former that a problem hardly became, it turned out that it is the material which is hard to disassemble automatically, and it was desirable to perform some decomposition treatment, such as heating and a chemical treatment, to waste liquid crystal panels. As for waste liquid crystal panels, when carrying out reclamation processing of the liquid crystal panel which uses a chromium metal for a color filter substrate in order to prevent reflection as it is, there was also voice which worries that it may become hexavalent chromium by acid rain, and it was desirable to collect and carry out stabilizing treatment.

[0067] However, in the discarding treatment method of this embodiment, since recycle processing of the waste liquid crystal panels is carried out under the elevated temperature which exceeds 1200 °C after crushing and in a non-iron refining furnace, the liquid crystal contained in crushed waste is disassembled within a furnace, and a chromium metal serves as an oxide and is detoxicated. Environment and discarding treatment safe also for a human body can be realized by this, and, as a result, the recycling rate of waste liquid crystal panels can also be raised.

[0068] Although the processing which throws crushed waste into a non-iron refining furnace was mentioned as an example of recycle processing in this embodiment, it is not necessarily limited to this processing. When crushed waste consists only of glass waste, recycle processing to tile raw material can be performed by kneading it with a tile material, and fabricating and calcinating it, after crushing the crushed waste concerned until it becomes comparatively small. The recycle processing to the roadbed material by mixing small glass waste into the asphalt of a road is also possible, and a subgrade life can be lengthened in this case. The recycle processing which mixes glass powder with the paint (reflective paint) used for a road sign, a signboard, etc. will also be possible, reflectance can be raised in this case, visibility can be raised, and an effect will especially be seriously demonstrated in night.

[0069] In the former, when recycling of glass was considered, for example, it is made

desirable to separate a polarizing plate from the glass substrate of a liquid crystal panel, and the peeling methods included the following four kinds of methods, for example.

[0070]** A mechanical method which starts one corner of a polarizing plate by knife edge, grasps this portion, and exfoliates.

[0071]** Heating and a mechanical method which uses together the mechanical method of the above-mentioned **, and exfoliates after heating the whole liquid crystal panel in which the polarizing plate was stuck to 80-150 ** and reducing the adhesive power of a polarizing plate adhesive material.

[0072]** Low temperature and a mechanical method which performs mechanical stripping work after cooling the whole liquid crystal panel in which the polarizing plate was stuck to -10--196 ** and reducing the adhesive power of a polarizing plate adhesive material.

[0073]** A solvent and a mechanical method which exfoliates mechanically after reducing the adhesive power of a polarizing plate adhesive material with solvents, such as ethyl acetate, IPA (isopropyl alcohol), and acetone.

[0074]The removing operation of the polarizing plate is generally said for automation to be difficult, each above-mentioned method is based on handicraft, therefore removing operation takes huge processing time to it. However, in the discarding treatment method of this embodiment, the complicated removing operation of such a polarizing plate is unnecessary entirely, as a result discarding treatment can be simplified and a cleanup cost can be reduced certainly.

[0075]Although the following problems are also further produced by the describing [above] all directions method, though natural, it is not necessary by the method of this embodiment to take these problems into consideration, since the removing operation of a polarizing plate is unnecessary as mentioned above. That is, the method of the above-mentioned **-* takes a complicated mechanism, in order to correspond to all of variety **** panel size. As a result, stripping work becomes complicated, a glass crack etc. occur and conveyance and post-processing become difficult. In the method of the above-mentioned **, a polarizing plate begins to deteriorate, and it becomes that it is easy to split in the extension direction, or becomes difficult to separate conversely. When the polarizing plate has stuck only on one side, it is the difference of the rate of expansion between glass and a polarizing plate, and a liquid crystal panel curves greatly and exfoliation of a subsequent polarizing plate becomes difficult. In the method of the above-mentioned **, a polarizing plate adhesive material swells and it remains to a glass surface, and the liquid crystal panels to which the polarizing plate separated adhere, it overlaps and post-processing becomes difficult.

[0076]It has a complicated process that structure improves [a recovery rate] component each of complicated liquid crystal panels recycle processing with individually sufficient or quality, or there are also many items which make a device, equipment or maintenance of a processing maker, maintenance of the conveying method, etc. establish, and there is much difficult SUBJECT. For example, although the fluorescent tube for Lighting Sub-Division contained in a liquid crystal module although how to crush a liquid crystal module, without spending time and effort and expense is also considered is little, if it is using mercury and crushes it as it is, it will pollute work environment. Therefore, the exclusion device for excepting mercury is needed in this case, and a cost hike is invited. Sorting (it sifts out and based on a wind force, hydraulic power, specific gravity,

magnetism, ****, etc.) after liquid crystal module crushing reduces the collection rate by type notably also about other materials.

[0077]However, since the method of this embodiment is recycled without collecting one one-piece components of a liquid crystal panel as mentioned above, it does not raise the cost in a device or an equipment surface. The method of this embodiment is the recycling technique which enabled reduction of the cost burden of consumers or a maker, and simplified the processing system of the member.

[0078]

[Effect of the Invention]The discarding treatment method of the liquid crystal panel concerning the invention of Claim 1 is composition which crushes a liquid crystal panel as mentioned above after the liquid crystal has entered at least, and carries out recycle processing of the crushed waste.

[0079]So, since waste liquid crystal panels are crushed and recycle processing of this is carried out, the discarding quantity to the reclaimed ground of waste liquid crystal panels can be reduced. This does so the effect that it can respond also to increase of the waste liquid crystal panels accompanying increase of the demand of future liquid crystal panels.

[0080]Since waste liquid crystal panels are crushed after the liquid crystal has entered at least, it is unnecessary, and the process of extracting a liquid crystal can make unnecessary the extracting apparatus and help concerning this extraction process, and can reduce a cleanup cost. By carrying out crushing treatment of the waste liquid crystal panels, the capacity of waste liquid crystal panels can be reduced substantially, and, as a result, the effect that storage and transportation can also be performed easily is collectively done so.

[0081]The discarding treatment method of the liquid crystal panel concerning the invention of Claim 2 is composition which is the processing which throws into a non-iron refining furnace the liquid crystal panel which crushed the above-mentioned recycle processing in the composition of Claim 1 as mentioned above.

[0082]So, the effect that the impurity (for example, iron) which exists in a non-iron refining furnace can be removed is done by adding to the effect by the composition of Claim 1, and supplying to a non-iron refining furnace after crushing this, since the liquid crystal panel contains SiO_2 to some extent.

[0083]Although organic matters, such as a polarizing plate and a liquid crystal, are contained in the crushed liquid crystal panel, since such an organic matter serves as a combustion material, it does so collectively the effect that a non-iron refining furnace can be heated, with energy saving.

[0084]The discarding treatment method of the liquid crystal panel concerning the invention of Claim 3 is composition which crushes a liquid crystal panel with 1 axis shearing type shredder in Claim 1 or the composition of 2 as mentioned above.

[0085]So, in Claim 1 or the effect by the composition of 2 in addition, by using 1 axis shearing type shredder for crushing of waste liquid crystal panels, Even if the polarizing plate, the circuit for a liquid crystal drive, etc. are attached to waste liquid crystal panels even if and the charge of hardwood and the charge of soft wood are laminated, Waste liquid crystal panels can be crushed certainly, the capacity in the total of waste liquid crystal panels can be reduced certainly, and the effect that this can also perform storage and transportation still more easily is done so.

[0086]Waste liquid crystal panels become waste with fine size and shape which is easy to

throw for example, into a non-iron refining furnace by crushing by 1 axis shearing type shredder. Therefore, in throwing in and carrying out recycle processing of the crushed waste to a non-iron refining furnace, crushed waste can be thrown in in large quantities, the reduction efficiency of an impurity can be raised, and it does so collectively the effect that recycle processing can be performed, in the state where it was dramatically stabilized by this.

[0087]The discarding treatment method of the liquid crystal panel concerning the invention of Claim 4 is composition which crushes a liquid crystal panel in one composition of the Claims 1-3 as mentioned above where a polarizing plate is attached.

[0088]So, since the complicated removing operation of the polarizing plate by handicraft is unnecessary, the effect that in addition to the effect by one composition of the Claims 1-3 discarding treatment can be simplified and a cleanup cost can be reduced certainly is done.

[0089]The discarding treatment method of the liquid crystal panel concerning the invention of Claim 5 is the composition that the circuit for a liquid crystal drive crushes a liquid crystal panel in the state where it was connected, in one composition of the Claims 1-4 as mentioned above.

[0090]So, since the complicated removing operation of the circuit for a liquid crystal drive by handicraft is unnecessary, the effect that in addition to the effect by one composition of the Claims 1-4 discarding treatment can be simplified and a cleanup cost can be reduced certainly is done.

CLAIMS

[Claim(s)]

[Claim 1]A discarding treatment method of a liquid crystal panel crushing a liquid crystal panel in a discarding treatment method of a liquid crystal panel which carries out discarding treatment of the liquid crystal panel which became unnecessary after a liquid crystal has entered at least, and carrying out recycle processing of the crushed waste.

[Claim 2]A discarding treatment method of the liquid crystal panel according to claim 1, wherein the above-mentioned recycle processing is processing which throws a crushed liquid crystal panel into a non-iron refining furnace.

[Claim 3]A discarding treatment method of the liquid crystal panel according to claim 1 or 2 crushing a liquid crystal panel with 1 axis shearing type shredder.

[Claim 4]A discarding treatment method of the liquid crystal panel according to any one of claims 1 to 3 crushing a liquid crystal panel where a polarizing plate is attached.

[Claim 5]A discarding treatment method of the liquid crystal panel according to any one of claims 1 to 4, wherein a circuit for a liquid crystal drive crushes a liquid crystal panel in the state where it was connected.
